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Cover

NASA's New Team—James M. Beggs (top right) was sworn in as NASA's sixth Administrator at a White House ceremony July 10. Beggs' nomination was confirmed by the Senate on June 25. Officiating was Vice President George Bush (top left); at center is Beggs' wife, Mary. Beggs succeeds Dr. Robert A. Frosch who resigned Jan. 20, 1981 to take over as the first president of the American Association of Engineering Societies in New York. Beggs previously was an executive vice president and a director of General Dynamics Corp., St. Louis, Mo.

Dr. Hans Mark (bottom center) was sworn in as NASA's new Deputy Administrator on July 10 at ceremonies at NASA Headquarters, Washington, D. C. Dr. Mark's nomination was confirmed on July 8. Officiating was new NASA Administrator James M. Beggs. Dr. Mark's wife, Marion, looks on at bottom left. Mark succeeds Alan M. Lovelace who joined General Dynamics Corp., St. Louis, Mo., as Corporate Vice President—Science and Engineering. Formerly Mark had served as Secretary of the Air Force from July 1979 to January 1981.

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Letter from Washington

As you know by now, I was sworn in as NASA's sixth Administrator on July 10.

The Space Program has come a long way in the 12 years since I last served with NASA as the Associate Administrator for the Office of Advanced Research and Technology in 1968 and 1969.

Twelve men have landed on the Moon, the Mariners, the Pioneers, the Vikings and the Voyagers continue to probe the secrets of the planets and the solar system. Communications, weather, navigation and other satellites continue to raise our standard of living on Earth. The first flight of the Shuttle and the Voyager Saturn flybys have again thrilled the Nation and reminded us all of NASA's great achievements.

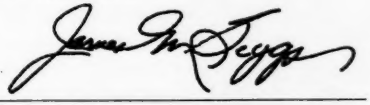
I am proud to be a part of the NASA team once again.

With the Space Shuttle we have, at long last, the tool to build on and to better these achievements so as to make the future as bright as the past.

The challenge is just as great; the opportunities greater.

As we look forward to the second launch of the *Columbia*, I have never been more aware of the dedication and professional pride of all the NASA employees.

I am delighted to be back and look forward to working with you all to keep NASA moving ahead into a new space era.



Biog Sketches on NASA's New Team

President Reagan nominated **James M. Beggs** for the post of NASA's sixth Administrator on April 23. At that time, Beggs was Executive Vice President, Aerospace, and a director of General Dynamics Corp., St. Louis, Mo., and had been responsible for General Dynamics Convair, Fort Worth and Pomona Divisions.

He served with NASA in 1968–69 as Associate Administrator , Office of Advanced Research and Technology. From 1969 to 1973, he was Under Secretary of Transportation. He went to Summa Corp. as Managing Director, Operations and joined General Dynamics in January 1974. Before joining NASA, he had been with Westinghouse Electric Corp. for 13 years.

A 1947 graduate of the U.S. Naval Academy, he served with the Navy until 1954. In 1955, he received a master's degree from the Harvard Graduate School of Business Administration.

A member of the Board of Governors of the National Space Club, the National Security Industrial Association and the American Astronautical Society, his other professional affiliations include the National Academy of Public Administration, the American Institute of Aeronautics and Astronautics, the American Society of Naval Engineers and Sigma Tau.

He holds an honorary LL.D degree from Washington and Jefferson College, Washington, Pa., and an honorary doctor of engineering management degree from Embry-Riddle Aeronautical University, Daytona Beach, Fla.

President Reagan nominated **Dr. Hans Mark** for the post of NASA's Deputy Administrator on April 23. He had previously served as Secretary of the Air Force from July 1979 until February 1981 and as an Air Force Under Secretary since 1977.

In February 1969, Mark became director of NASA's Ames Research Center, Mountain View, Calif. where he managed the center's research and applications efforts in aeronautics, space science, life science and space technology.

Following completion of graduate studies, Mark remained at MIT as a research associate and acting head of the Neutron Physics Group, Laboratory for Nuclear Science, until 1955. He then returned to the University of California at Berkeley as a research physicist at the University's Lawrence Radiation Laboratory in Livermore until 1958. He subsequently served as an assistant professor of physics at MIT before returning to the University of California's Livermore Radiation Laboratory where he served as a professor and headed the Laboratory's Experimental Physics Division from 1960 until 1964.

Mark was born in Mannheim, Germany June 17, 1929 and came to the United States in 1940. He became a citizen in 1945. He received his bachelor's degree in physics from the University of California at Berkeley in 1951 and his doctorate in physics from the Massachusetts Institute of Technology in 1954.

Soviet Launched U.S. Experiments Yields New Findings on Weightlessness

Fourteen United States experiments, launched in fall 1979 aboard an unmanned Soviet satellite (Cosmos 1129), have yielded valuable information about the effects of weightlessness on physiological processes and on plant growth. U.S. experimenters found changes in enzymes and in animal bone strength, growth rate and mineral content similar to some changes experienced by astronauts and cosmonauts. These findings have brought new explanations for some of the problems of weightlessness. Plant growth showed no ill effects from spaceflight.

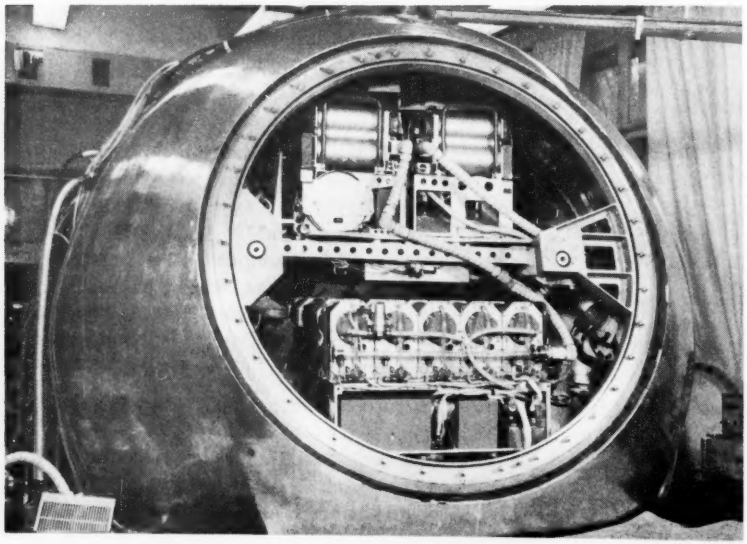
The major 1979 Cosmos payload was 37 white rats and 60 fertile Japanese quail eggs provided by the Soviets and shared by participating experimenters. U.S. scientists provided carrot tissue cultures, plantlets and carrot slices inoculated with bacteria which can form tumors in plants.

In Moscow, scientists set up two groups of control animals identical to those in space. One group was left in normal laboratory cages and fed the flight-type diet. The other group, the synchronous control, was housed in an identical spacecraft on the ground, subjected to vibration and gravity forces of launch and reentry, and experienced any environmental changes occurring in the orbiting craft as those changes were transmitted to Earth. The only difference between the synchronous control group and the flight animals was the experience of weightlessness.

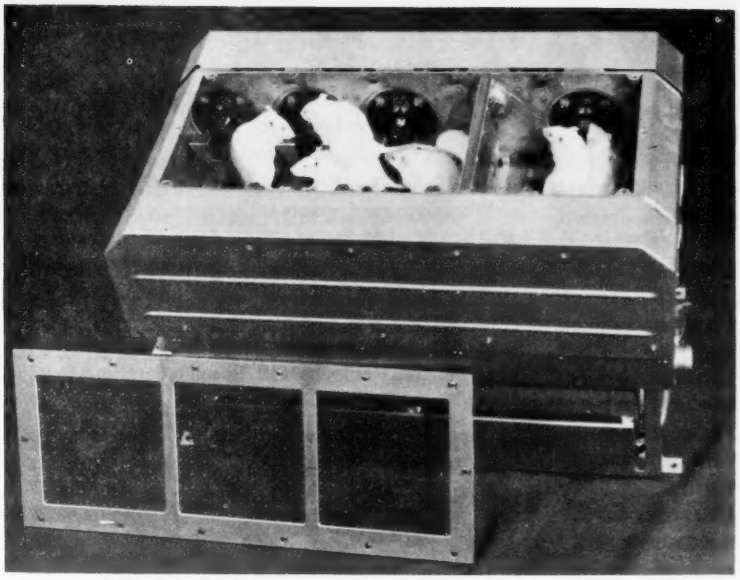
After the Cosmos flight, the animals were recovered immediately, before they could readapt to Earth gravity. The Soviet recovery team moved rapidly to the landing site and set up a mobile laboratory to perform autopsies on about one-fifth of the animals. The remaining animals were flown to Moscow, where some were autopsied after six days of readaptation to gravity, and the remainder after 29 days.

U.S. studies of changes in animal muscle fibers and animal bone formation, turnover and strength were important because of the decrease in muscle strength and calcium loss observed in astronauts and cosmonauts during prolonged spaceflight. After the flight, the Cosmos rats showed a 20 percent deficiency in total bone mineral content, compared to synchronous control subjects.

Normal bone is constantly resorbed and replaced by newly formed bone, with the total amount of bone remaining constant in an adult human or animal. During spaceflight, production of new bone appears to slow down, but resorption continues, resulting in a net loss of bone and decreased strength. Changes are greatest in weight-bearing bones, but even bones that do not bear weight, such a jaw bones, show changes in mineral composition and reduced formation of cells which synthesize new bone.



Mock-up of Cosmos equipment inside the Vostok spacecraft, showing the arrangement of the rat cages. The mock-up was used as the Synchronous Control on the ground.



The rat mating chamber launched aboard Cosmos 1129 in Fall 1979 with two males and five females in separate compartments. On the second day in orbit, doors in the partition were opened, allowing the rats to mingle. The dark discs are feeding stations, where a paste diet and water were dispensed.

Muscle changes in rats were studied by determining the proportions of two major muscle fibers: "fast twitch" fibers which fatigue rapidly and "slow-twitch" fibers which fatigue more slowly. One function of slow fibers is to maintain posture against gravity.

Muscle mass was lower in the flight animals than in the ground controls, and the ratio of slow to fast fibers decreased. Apparently, some slow (anti-gravity) fibers were converted to fast fibers during spaceflight.

The livers of flight rats contained more glycogen and less of some complex fats than the livers of control rats. The change correlated with a lowered activity of two enzymes which synthesize these fats. Two other enzymes important for using oxygen to produce energy also showed lowered activity. Another group of flight rats showed a shift of body water from skin and muscles to internal organs in the absence of gravity.

The mission included the first attempt to breed mammals in space. The Soviet experiment was designed to mate rats in space and follow early embryonic development in weightlessness. The experiment did not succeed, however, and no litters were produced. To the surprise of Soviet and U.S. scientists, the same results were obtained with the synchronous control subjects. The scientists still are seeking an explanation for the failure.

The fertilized quail eggs provided limited information about embryonic development, because the incubator failed on the 13th day of flight.

Plants showed no ill effects from spaceflight, an encouraging result for prolonged space missions. Carrot embryos and plantlets developed normally in space, growing to normal, mature plants after returning to Earth. The growth rate of plant tumors on carrot slices was the same in space as on the ground, a finding which suggests that metabolism in carrot tissue is unaffected by spaceflight.

The next opportunity for U.S. participation in a Cosmos mission will be mid-1982. Tentative plans are for the United States to provide instruments to measure blood pressure and flow in two Rhesus monkeys during a flight of about two weeks. Joint U.S./U.S.S.R. studies also are planned of the monkeys' metabolism, biorhythms and bone metabolism. The 1982 flight, the first Soviet attempt to orbit monkeys, will provide an opportunity to study the effects of spaceflight on an animal more similar to humans than the rat.

The Vostok spacecraft, which was launched into an elliptical orbit and recovered 18½ days later within the Soviet Union, was similar to those used on two previous Cosmos missions in 1975 and 1977 in which the United States participated. Cosmos is inexpensive for the United States because the cost

of the spacecraft and support activities is borne by the Soviet Union. Cosmos also offered the only U.S. opportunities since 1975 for biological research in space.

Forty scientists representing 18 U.S. universities and research organizations participated in the Cosmos project, which is managed in the United States by the NASA Ames Research Center, Mountain View, Calif. Project manager at Ames is Kenneth A. Souza and deputy manager is Dr. Milton R. Heinrich.

NASA and Industry Participate In Computer Science Study

NASA invited computer scientists in industry and government to participate with university faculty members and NASA's own researchers in a 10-week workshop called "Computer Science: Key to a Space Program Renaissance."

The industry input is designed to help set the course for future NASA research and development in computer science and also, indirectly, to determine the nature of later spinoffs from the agency's work back to industry.

NASA is seeking ways to increase its productivity in both space and on the ground. To do this and so make increasingly sophisticated missions more affordable, the agency is putting emphasis on computer science as the support technology most in need of an intensive research and development commitment. This summer's workshop, managed by Goddard, lays the groundwork for a commitment. This will be accomplished by exploring the potential of modern computer technology across the gamut of space activities: planning, design, testing, operating, controlling and managing space missions, plus the multitude of supporting activities.

The workshop was scheduled from June 9 to Aug. 14 at the University of Maryland's Donaldson Brown Center in Port Deposit, Md. It is being directed by NASA's Office of Aeronautics and Space Technology with support from all the agency's offices.

"NASA is particularly interested in obtaining technical and policy advice from Fortune 500 and high technology aerospace companies," says workshop co-director Dr. Paul Schneck at Goddard Space Flight Center, Greenbelt, Md. An interdisciplinary team of 20 university and 10 NASA researchers forms the core of the group for the study. By assisting the team, Schneck said, the industry experts will have the opportunity to contribute to a study of highly complex, innovative systems technology which will influence the evolution of the nation's space program at every level, from office performance to the structure of new satellite missions.

Workshop participants will prepare a technology assessment of computer science for NASA, draw up a model technology program identifying critical agency technology needs, and plan a model development program. Many of the results of the study, the sponsors predict, can be used by other high technology government agencies as well. Specific questions that the workshop will address include:

- How can NASA apply computer technology more effectively in the missions it flies (from design through fabrication and test, and into mission operations);
- How can computer science and technology be used to improve the operation of NASA as a government agency;
- How can NASA effectively contribute to progress in computer science and technology;
- What basic/applied computer science research should NASA be conducting;
- How can/must the agency change in order to take full advantage of computer science and technology;
- How can computer science and technology be used to improve the quality, timeliness, cost, etc., of the agency's products.

NASA Forum with SES Women

NASA currently employs 22,311 permanent, full-time employees; of this total 434 are Senior Executive Service positions—eight of which are filled by women. In June, six of these women participated in a forum at Headquarters to relate some of their experiences and offer advice to employees seeking career direction and advancement. The program offered an opportunity for employees to meet and honor the SES women and allowed a dialogue with one or more of them in small group sessions. The SES women rotated among the groups and met employees from many offices representing a

variety of work experiences at different grade levels.

Although the executives had different backgrounds and different experiences, all described their career rise to the top in terms of perseverance, dedication, opportunities taken and sacrifices made. The audience of over 100 employees applauded the hope that one day sessions such as this one will be unnecessary because of the large number of SES women.

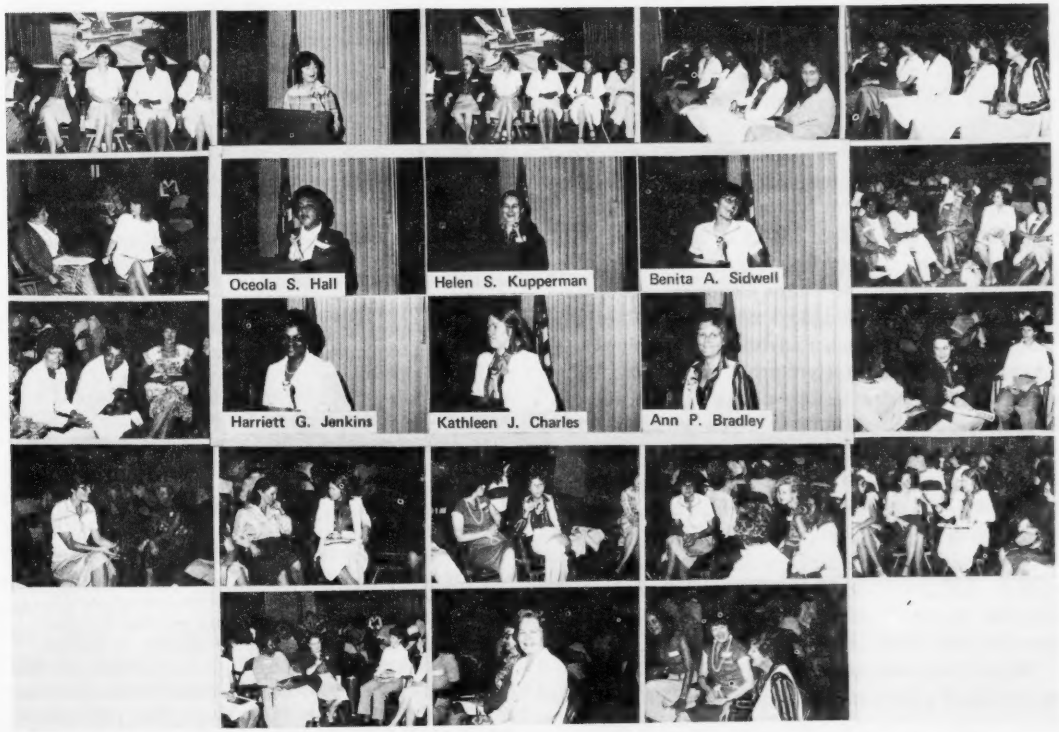
Five of the six SES women were from Headquarters: Ann P. Bradley, Deputy Associate Administrator for Management Operations; Kathleen J. Charles, Director, Administration and Management Division, Office of Space and Terrestrial Applications; Oceola S. Hall, Director for Discrimination Complaints for NASA; Dr. Harriet G. Jenkins, Director, Equal Opportunity Programs for NASA; and Helen S. Kupperman, Assistant General Counsel for General Law. The sixth participant was Benita A. Sidwell, Director of Management Operations, Goddard Space Flight Center.

NASA's two remaining SES women were unable to attend the program: Carol A. Sweeney, Assistant to the Comptroller for Management Policy Review and Analysis, Headquarters; and Dr. Adrienne Timothy, Chief, Applications Systems Analysis Office, Goddard.

The NASA SES forum was organized by the Headquarters Federal Women's Program Manager, Mary Anne Stoutsenberger and by Team 1 of the Headquarters Management Process—Jean Arena, Mary Fitzpatrick, Doris Goodwin, Danalee Green, Bonnie Henderson, Bertha Lee, and Muriel Thorne. The Management Process is a NASA career training program developed by Priscilla Elfrey, Headquarters Office of Management Operations, and George Peabody, consultant.

Finalists Chosen In Shuttle Student Project Competition

Ten finalists have been selected in the first national Space Shuttle Student Involvement Project, a joint venture of NASA and the National Science Teachers



Scenes from NASA's forum with SES women held at Headquarters June 4.

Association. Finalists were chosen from 191 semifinal entries based on individual scientific or engineering merit for potential flight aboard the Space Shuttle.

The objective of the project is to stimulate the study of science and technology in grades 9 through 12 by engaging students in a competition to develop experiments suitable for flight aboard the Space Shuttle.

The contract to conduct the competition was awarded last summer by NASA to the National Science Teachers Association, with headquarters in Washington, D.C. Interdisciplinary teams of teachers, scientists and engineers reviewed more than 1,500 proposals, grouped them into 10 geographic regions, and selected semifinalists. Regional conferences for the semifinalists were held this spring at various NASA field centers.

Semifinalist proposals then were judged by a national team which selected the 10 finalists. Panelists on the judging team included representatives from NASA, National Science Teachers Association, National Science Foundation, National Institutes of Health, Department of Education, American Association for the Advancement of Science and several universities and consulting firms.

The 10 national winners and their teacher-advisors will attend a special Space Shuttle conference in August at NASA's Kennedy Space Center, Fla.

The students will receive instructions and advice on how to prepare their experiments for assignment and review the procedures for integrating their experiments into a specific Space Shuttle mission. Finalists and teachers will tour the Kennedy Space Center facility and will view the Shuttle *Columbia* in preparation for its second flight in September.

Finalists, science teacher advisors and winning entrants' schools will receive special medallions. All entrants in the competition have received a certificate of participation.

To broaden participation in the program, NASA is encouraging U.S. industrial firms and other groups to sponsor student winners and assist them in transforming winning proposals into experiments. Industries or other organizations interested in serving as a sponsor should write to Glen P. Wilson, Acting Director, Academic Affairs Division, NASA Headquarters, Mail Code LC-16, Washington, D.C. 20546.

Winning national Space Shuttle Student Involvement Project experiments will be assigned to specific Shuttle flights as the experiments are ready, as space is available and as future Shuttle flights are confirmed.

Student experiments will be placed in storage lockers in the mid-deck section of the orbiter and not in the cargo bay areas as for operational payloads. Assisted by the sponsor and/or a NASA advisor, the student will analyze the data returned from the experiment and prepare a final report. All scientific data from the student experiments will be in the public domain and made available from the National Space Science Data Center at NASA's Goddard Space Flight Center, Greenbelt, Md.

A second Space Shuttle Student Involvement Project contest will open in September with regional conferences to be held in March 1982 and student winners selected in May 1982.

First Getaway Special—R. Gilbert Moore, Ogden, Utah (center), and Dr. Stanley I. Weiss, NASA Associate Administrator for Space Transportation Operations, sign the first Launch Services Agreement for a Small, Self-Contained Payload, as Mrs. Donna Miller, NASA Project Manager for the program looks on. Mr. Moore, the first of 308 individuals and organizations to submit earnest money deposits for small payloads to be flown on a space available basis on the Space Shuttle, has donated the first payload to five educational institutions: Utah State University, Logan, Utah; the University of California-Davis; Weber State College and Weber High School, Ogden, Utah, and the Box Elder High School, Brigham, Utah. The experiments to be provided by these institutions range from algae and duckweed growth in space to fruit fly and brine shrimp genetic studies. Mr. Moore is General Manager of the Thiokol Astro-Met Plant in Ogden. The Small, Self-Contained Payload program, also called the "Getaway Special" program, provides for small scientific, educational or commercial research experiments to be flown in the Space Shuttle cargo bay in NASA-provided containers. They require no special services such as electrical power or deployment outside the Shuttle. They cost between $3,000 and $10,000 depending on weight and volume which can be up to five cubic feet and 200 pounds.

HEAO-3 Completes Flight Mission

NASA's third High Energy Astronomy Observatory, HEAO-3, has expended the last of its supply of thruster gases used for attitude control, and has been powered down. This completes a mission begun Sept. 20, 1979, when the observatory was launched aboard an Atlas-Centaur rocket.

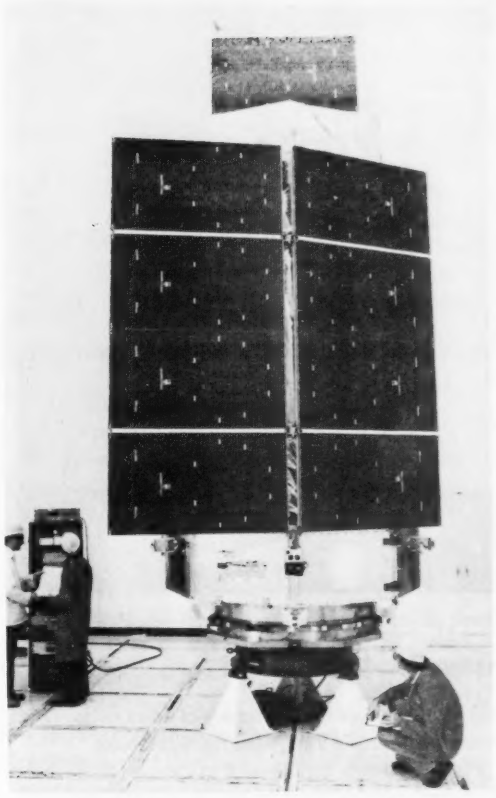
HEAO-3 is the third in a family of three highly successful scientific satellite observatories managed by the Marshall Space Flight Center in Huntsville, Ala., for NASA's Office of Space Science. These spacecraft gave astronomers a new capability to study some of the most intriguing mysteries of the universe: pulsars, quasars, exploding galaxies and black holes in space. The high energy rays produced by such sources cannot be studied effectively through Earth-based telescopes because of the obscuring effects of our atmosphere.

The first HEAO was launched in 1977 to conduct a mapping of the X-ray sources in the heavens. The second satellite, launched in 1978, provided the earliest spacecraft-generated X-ray images of astronomical objects such as galaxies and nebulae.

HEAO-3 carried instruments designed to perform an all-sky survey of gamma rays and cosmic rays. One objective was to measure the spectrum and intensity of both diffuse and discrete sources of gamma radiation. In addition, the observatory carried an instrument that observed very high energy atomic nuclei in the cosmic rays and measured the composition and energy of these nuclei to determine the abundance of the individual elements.

After a series of planned instrument and spacecraft engineering tests was performed, all systems were powered down on May 30. With 20 months of operating time on orbit, HEAO-3 performed for more than three times its design life. Reentry and burn-up are expected to take place later this year.

The scientific instruments on HEAO-3 were designed by scientists at the California Institute of Technology; Washington University in St. Louis; the University of Minnesota; the Jet Propulsion Laboratory, Pasadena, Calif.; the Danish Space Research Institute in Denmark; and the Center for Nuclear Studies in France. TRW Systems, Inc., as the HEAO prime contractor, developed, integrated and supported the operation of the observatory. Overall management and direction of the HEAO project was performed by the Marshall Center for the Office of Space Science.

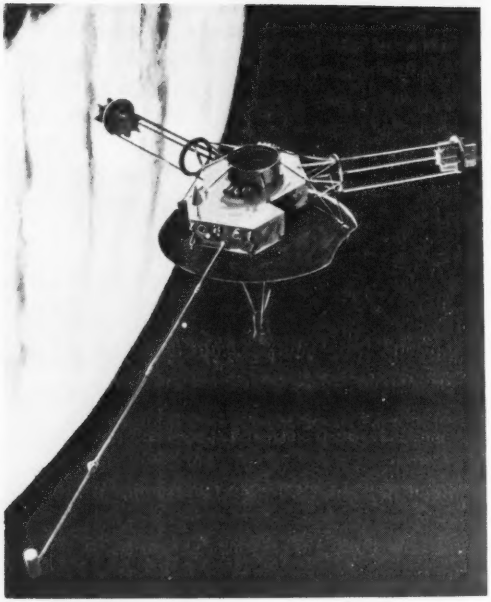


NASA's third High Energy Astronomy Observatory, HEAO-3, which recently expended the last of its supply of thruster gases. HEAO-3 was launched Sept. 20, 1979 aboard an Atlas-Centaur rocket.

Pioneer 10 Finds Solar Atmosphere Extends Enormous Distance

Pioneer 10, now a little over halfway between the orbits of Uranus and Neptune past Pluto, has found that the Sun's atmosphere and magnetic envelope "extend an enormous distance—far beyond the point predicted by many scientists," according to J. A. Van Allen, Pioneer investigator.

This discovery means that "if you were living on any other planet, you would find a solar environment surrounding it like that surrounding the Earth. This would include: a constant solar wind, buffets by solar magnetic storms, and, in many cases, radiation belts,"



Artist's concept of Pioneer 10 spacecraft, launched March 3, 1972, now a little over halfway between the orbits of Uranus and Neptune past Pluto.

said Van Allen, of the University of Iowa, who discovered Earth's Van Allen radiation belts.

Pioneer 10 data can be used to forecast that Voyager 2 will find such "solar" conditions during its encounter with the planet Uranus in 1986, he added. The findings also predict similar solar environment conditions for Neptune. Van Allen and other Pioneer investigators discussed these results at a special celebration of Pioneer 10's crossing of the silver (25th) astronomical unit (AU) from the Sun this year. (An astronomical unit is the distance from the Earth to the Sun, about 150 million kilometers, and is the conventional space yardstick for solar system measurements.)

On July 26, Pioneer 10 will reach the 25 AU mark or 3,739,947,300 km from the Sun. As far out as Pioneer 10 now is, at 25 AU, it takes 3 hours and 28 minutes for spacecraft data traveling at the speed of light to reach the Pioneer Operations Center at NASA's Ames Research Center, Mountain View, Calif.

Pioneer 10 is managed by NASA's Ames Research Center. It was built by TRW Systems, Redondo Beach, Calif. Information from Pioneer 10 proves the Sun's influence extends to at least 25 AU and probably well beyond. The scientists found no clear evidence of a close approach as yet to the heliopause. The heliopause is the border between the Sun's atmosphere and interstellar space, the medium between the stars.

Some scientists had predicted that the heliopause would be found as close to the Sun as 5 AU. Our Sun is a star, the only star we can study in detail from close up. It is also a star typical of the majority of stars in the universe. Hence the new findings about the character and scale of the Sun's atmosphere and magnetic envelope greatly increases our understanding of other stars, and the environments of any planets they may have, the scientists noted.

NASA and Italian Engineers Discuss Tethered Satellite

A series of meetings which may bring the United States and Italy a step closer to a joint space effort were held at NASA's Marshall Space Flight Center in Huntsville, Ala., on June 17 and 18. Engineers from the Marshall Center and Italian space officials discussed recent studies of NASA's proposed Tethered Satellite System.

This project, managed by the Marshall Center, calls for a data-gathering satellite to be carried into orbit by the Space Shuttle and then released from the payload bay on a tether—a super-strong cord that can be as long as 97 kilometers. The satellite, attached to the Shuttle by the tether line, will be trolled through the Earth's upper atmosphere to gather atmospheric, magnetospheric and gravity data.

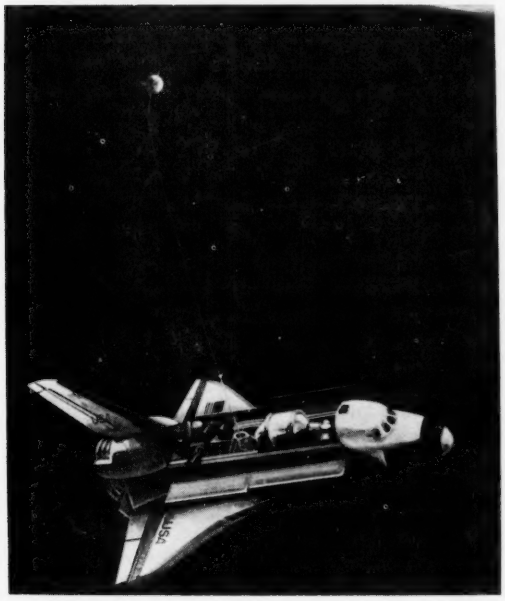
The Italian scientific community first became interested in participating in the tethered satellite project about a year ago, following the review of a study by Marshall engineers and aerospace contractors. Since that first meeting with the Italians, NASA has proposed that a cooperative effort may be possible.

"If such a joint venture were to be undertaken," said Jay Laue, an engineer in the Marshall Center's Advanced Systems Office and manager of the tethered satellite study team, "the Italians would build the satellite and the United States would build the deployer and handle the systems integration." The

deployer would be the boom and related apparatus to fit inside the Shuttle's cargo bay.

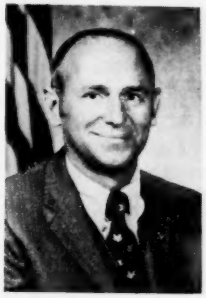
Unlike sounding rockets which remain in the atmosphere for only a few minutes, or the low-altitude non-propulsive satellites which gather data for only a few hours before their orbits decay, the tethered satellite can be pulled through its extremely low orbit, perhaps only 130 km above the Earth, for an extended period.

Operating under a "Letter of Agreement" with NASA, the Italian engineers have initiated studies of the tethered satellite project in such areas as satellite system trade-offs, advanced experiment planning and satellite design approaches. They briefed the Marshall engineers on their finding during the two-day meeting, and Marshall in turn briefed the Italians on current plans for development of the deployer and for the overall systems integration activity.



Artist's conception of NASA's proposed Tethered Satellite System. NASA and Italian officials recently met at Marshall Space Flight Center, Huntsville, Ala. to discuss a joint space effort on this system.

Astronaut Alan L. Bean Resigns



Astronaut Alan L. Bean, 49, fourth man to set foot on the Moon, submitted his resignation effective June 26 to devote full time to his career as an artist. Bean said in his 18 years as an astronaut, he visited worlds and saw sights no artist's eye has ever viewed first-hand, and he hopes to express these experiences through the medium of art.

Bean was among the third group of astronauts selected by NASA in the fall of 1963. He was lunar module pilot on Apollo 12, the second landing on the Moon in November 1969. He and Charles (Pete) Conrad Jr. explored the Ocean of Storms while Richard F. Gordon circled in the command module.

From July to September 1973, he was commander of the second Skylab mission. On that 59-day mission, Bean, with Jack R. Lousma and Owen K. Garriott, accomplished 150 percent of the pre-mission forecast goals.

His next assignment was as backup spacecraft commander for the United States flight crew on the joint U.S.-Soviet Apollo-Soyuz Test Projects in 1975.

Bean's 1,671 hours, 45 minutes in space rank him first among active American astronauts and fourth among all astronauts in total space flight time. During his career, Bean amassed 11 world records in space and astronautics, all of which have since been surpassed. He was head of the Astronaut-Candidate Operations and Training Group.

Bean's interest in art is not new. He began formal art training as a night school student while a test pilot in the Navy. His paintings are about what he knows best—the exploration of the Moon. He feels that the exploration of space has been the most historically-significant event of our time, and his purpose now is to make a contribution to art by capturing these events on canvas. He plans to pursue this goal in the Houston area.

With Bean's resignation, only one of the 12 Americans who have walked on the Moon remains in the astronaut corps. He is John Young, chief of the Astronaut Office and commander of the first Space Shuttle flight last April.

Natural Laser Discovered on Mars

Investigators at NASA's Goddard Space Flight Center, Greenbelt, Md., and the University of Maryland have discovered a natural infrared laser on Mars—an observation that could lead to the discovery of new planets in the universe and might force scientists to rewrite their books on general physics of the planetary atmosphere. The discovery, reported in *Science* magazine, was made by Dr. Michael J. Mumma, Dr. David Buhl, Dr. Gordon Chin, Dr. Drake Deming, Fred Espenak and Dr. Theodore Kostiuk, all of Goddard, and Dr. David Zipoy, of the University of Maryland.

In their paper, the scientists point out that since the invention of optical lasers some 50 years ago, they have proved extremely useful in scientific laboratories and in everyday life, where one of the most obvious uses has been the supermarket price scanners. "Despite this somewhat deceiving abundance of man-made lasers," they reported, "no naturally-occurring lasers have ever been reported, even though the extreme variety of physical and chemical environments of extraterrestrial objects plausibly argues that natural lasers must exist."

In theory, lasers occur when atoms or molecules are stimulated to release photons during their transition from higher energy to lower-energy states. This process was observed in the Mars atmosphere, composed almost entirely of carbon dioxide, between January and April 1980, through the use of a new Goddard-developed device and the Kitt Peak McMath Solar Telescope in Arizona. The new device is an infrared heterodyne spectrometer.

The new spectrometer provided the scientists with the means of determining that a molecular population inversion, which is necessary for lasing, did take place. In the case of this observation, sunlight was absorbed high in Mars' atmosphere by the carbon dioxide. In the absorption process, carbon dioxide is pumped to a higher energy state and builds into a laser state.

The discovery gives indication that there can be sizable temperature differences in the planetary atmosphere, whereas past theory has held there has been a thermodynamic equilibrium there.

The natural laser, discovered on Mars, is identical in physical principle to man-made carbon dioxide lasers used for commercial, scientific and military purposes. Examples of terrestrial use include laser radar systems, industrial laser welding machines, and laser surgical "knives." A principal difference between the Mars laser and terrestrial lasers is that the total power output of the natural laser exceeds one million megawatts, continuously, a power equivalent to that generated by about 1,000 large hydroelectric power projects. In fact, the power generated by the natural laser on Mars exceeds the total power output of the United States by more than five times. Eventually, it may be possible to extract power from the natural laser and to beam it wherever needed from orbiting satellites.

Shuttle Contamination Monitor Shipped

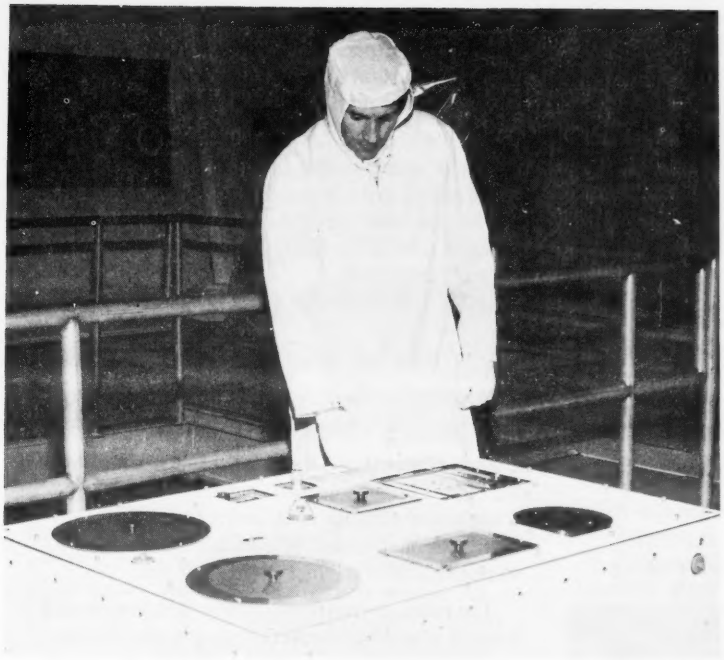
The Induced Environment Contamination Monitor (IECM), a desk-sized detector containing 10 instruments to check for contaminants in and around the Space Shuttle Orbiter cargo bay which might adversely affect delicate experiments carried aboard, was shipped July 6 from NASA's Marshall Space Flight Center, Huntsville, Ala., to the Kennedy Space Center, Fla. It is scheduled for flight on the second Shuttle mission, expected to launch September 30.

The IECM, developed by the Marshall Center, is scheduled to fly aboard Shuttle missions two, three and four, and will be a part of Spacelab missions one and two. Contaminants to be monitored during Shuttle flights might include any outgassing from materials within the Shuttle, as well as gases from the reaction jets which control the vehicle in orbit.

The IECM will operate during pre-launch, ascent, on-orbit, descent and post-landing. The on-orbit measurements include molecular return flux, background spectral intensity, molecular deposition and optical surface effects. During the other mission phases, dew point, humidity, aerosol content, and trace gas will be measured, as well as optical surface effects and molecular deposition.

These measurements will be made with 10 separate instruments: a humidity monitor, dew point hygrometer, air sampler, cascade impactor, passive sample array, optical effects module, temperature-controlled quartz crystal microbalance, cryogenic quartz crystal microbalance, camera/photometer, and mass spectrometer.

The IECM will operate attached to a release mechanism (also developed by the Marshall Center) in the cargo bay during the second Shuttle mission, but on later flights it will be released and will be



The Marshall-developed Induced Environment Contamination Monitor (IECM) receives a last-minute inspection from Larry Russell, Marshall's lead engineer for the IECM, before its shipment to the Kennedy Space Center. The IECM is a desk-sized detector containing 10 instruments to check for contaminants in and around the Space Shuttle Orbiter cargo bay which might adversely affect delicate experiments carried aboard. The contamination monitor is scheduled for flight on the second Shuttle mission expected to launch Sept. 30.

moved about and outside the cargo bay by means of the Orbiter's Remote Manipulator System for a closer check on contamination and then reattached.

The purpose of the IECM is to measure the actual environment to determine whether the strict controls placed on the Shuttle system have solved the contamination problem. With the IECM instrumentation, contaminant sources may be identified and eliminated. The IECM will also provide data on the interaction of the induced and natural environments, and will provide critical data for planning of future Shuttle payloads.

After each Shuttle flight, the IECM will be returned to the Marshall Center for refurbishment. The flight data will be combined with Orbiter data furnished by the Johnson Space Center for a comprehensive analysis. Project scientists for the IECM is Edgar R. Miller, a member of Marshall's Space Sciences Laboratory.

Launch Agreement Signed for German Shuttle Pallet Satellite

NASA and the West German firm Messerschmitt-Boelkow-Blohm GmbH (MBB) have signed a launch services agreement for the first flight of the Shuttle Pallet Satellite (SPAS-01) which will be carried into orbit on the first Space Shuttle operational flight (STS-5) now scheduled for September 1982. It will be the first payload to be deployed and retrieved by the Space Shuttle's Canadian-built Remote Manipulator System (RMS).

The agreement was signed June 12 at the MBB Space Division headquarters in Bremen, Federal Republic of Germany, by Dr. Stanley I. Weiss, NASA Associate Administrator for Space Transportation Operations, Dr. Johannes Schubert, MBB Space Division General Manager, and Dr. Peter C. Bittner, MBB Space Division Commercial Director.

The 1,814-kilogram SPAS-01 is designed to operate in the attached mode inside the Shuttle payload bay as well as in the deployed mode as a free flyer. In the deployed mode it is controlled by an onboard stabilization and control system.

MBB's primary purpose on this first flight is to conduct materials processing research experiments while SPAS is in the Shuttle payload bay. NASA will use the payload in a test of the remote manipulator system's deployment and retrieval capabilities during the five-day mission. A 70-mm camera mounted on SPAS will provide photo coverage during deployment, free flight, retrieval and reberthing on the Shuttle.

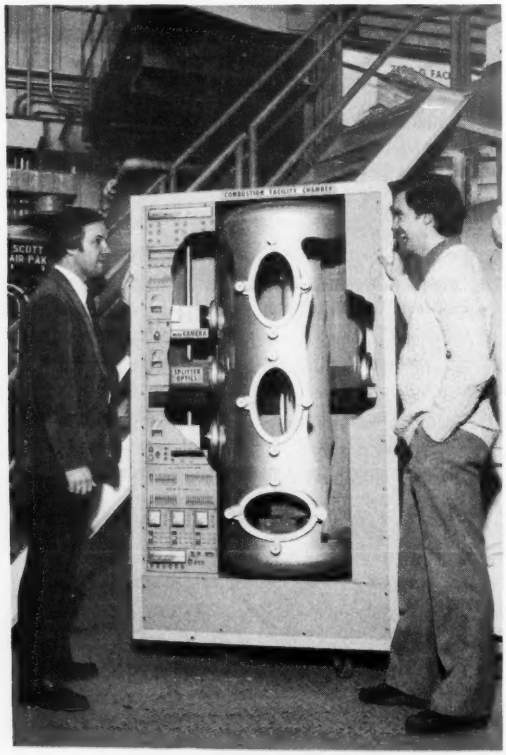
Lewis Combustion Facility to Ready Experiments for Shuttle

Researchers at NASA's Lewis Research Center, Cleveland, have designed a zero-gravity combustion facility—a test article that will provide broad-ranging capabilities for numerous combustion experiments to be carried out aboard the Shuttle-borne Spacelab.

Spacelab, built by the European Space Agency and scheduled for launch in 1983, will be a reusable space-borne laboratory that will accommodate a myriad of astronomical and basic science experiments.

Researchers in Lewis' In-Space Research and Technology Section are currently devising experiments for use in groundbased zero-gravity facilities, such as aboard Spacelab. Lewis Section spokesman, Lee Sarsfield, explained: "Many physical processes that are understood in our terrestrial environment operate quite differently or not at all when the effect of gravity is removed. The science of combustion, which impacts our lives here on Earth, is a strong candidate for zero-gravity research. Through various fundamental experiments, a much greater understanding of combustion for both space and terrestrial applications could be achieved."

The canister-like combustion facility has the following major elements: combustion chamber, gas and liquid supply systems and bottle storage area, combustion chamber vent assembly, combustion chamber console, satellite hardware and data acquisition and control subsystems.



Lewis' combustion flanked by Thomas Labus (left) and Lee Sarsfield of Lewis' In-Space Research and Technical Section.

Marshall Begins Tests To Reduce Shuttle Overpressure

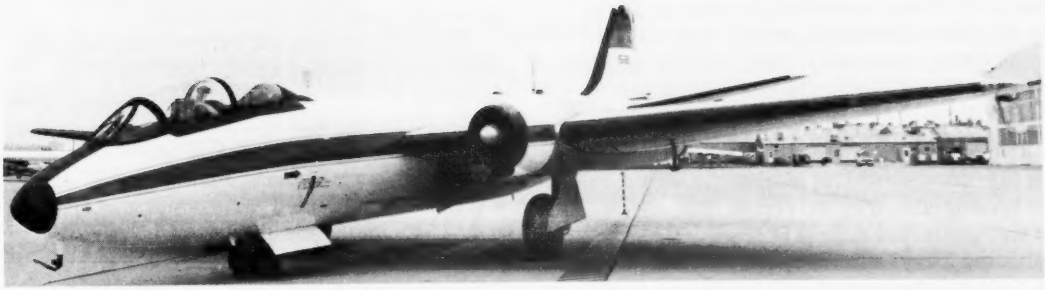
Engineers at NASA's Marshall Space Flight Center, Huntsville, Ala., began a series of tests in July in the center's acoustic test stand to determine a method of reducing stress loads on the Space Shuttle Orbiter caused by a pressure pulse detected during launch of the first Shuttle in April.

The pulse, or overpressure, occurred several milliseconds after Solid Rocket Booster ignition when pressure waves from the booster backed up through openings in the mobile launcher platform. According to Dr. George McDonough, director of Marshall's Systems Dynamics Laboratory, the one-sixth-of-a-second pulse caused excessive stress loads on the Orbiter's aft heat shield and elevons.

Marshall engineers are using a 6.4 percent scale model of the Shuttle Orbiter, Tomahawk rockets to simulate the Shuttle's boosters, and a scaled-down version of the mobile launcher to test a variety of potential changes that might be applied to the Kennedy Space Center launch facility to correct the problem. Eight simulated "Shuttle launches" are scheduled over the next few weeks to determine how best to prevent the overpressure pulse from reaching the Orbiter during the second Shuttle mission. The 6.4 percent model was previously used during Shuttle development.

Dryden Prepares for Turbulence Tests

NASA Dryden is readying its newly refurbished B-57B Canberra bomber to be the test airplane for for a new Atmospheric Turbulence Measurement Program. The program is constructed to gather information on turbulence patchiness and spanwise



Dryden's newly refurbished B-57B Canberra to be used as a test plane for Dryden's new Atmospheric Turbulence Measurement Program.

gust gradients—sudden changes in wind creating abrupt and uneven pressure forces on different areas of an aircraft. Aeronautical engineers will use the information to develop improved designs in aircraft construction and operation. They will give special attention to approach and takeoff during strong wind shears and unstable temperature conditions.

Researchers consider this program most important to flight safety. Sophistication of modern aircraft and need for all-weather operations call for increased knowledge in designing large vehicles and suitable control systems. Commercial airliners reportedly have suffered a number of bad incidents in recent years because of unpredictable performance in wind shears.

Project engineers chose the B-57B because of its ruggedness and ability to withstand high G-forces. The craft has extremely rigid wings and is strong enough to recover from upsets during severe turbulence. Its cockpit has space for two crew members—allowing a meterologist to fly as an observer during tests.

Dryden Flight Research Center will manage the entire flight test program. The B-57B will fly tests at Edwards Air Force Base, Denver, Oklahoma City, Huntsville, Cape Canaveral and Wallops Island—all of which possess distinctive types of turbulence. Other NASA centers participating in the joint program include Ames Research Center, Langley Research Center, and Marshall Space Flight Center. Dryden's project manager for the Turbulence Program is Wen Painter.

AE-5 Satellite Reenters Earth's Atmosphere

NASA's Atmosphere Explorer-5 (AE-5) reentered the Earth's atmosphere on June 10, after 31,268 orbits and more than 5½ years of service. The last signal was received from the spacecraft over Hawaii. Its descent trajectory was across the Pacific Ocean, Central America and into the Atlantic Ocean. No signal was received when it was due over Ascension Island. The North American Air Defense Command (NORAD) later confirmed that AE-5 reentered the atmosphere at 9:57 a.m. EDT in the Caribbean, east of Nicaragua.

The 720-kilogram satellite was launched from the Kennedy Space Center on Nov. 20, 1975. AE-5 carried a complement of 15 highly specialized scientific instruments which, during the mission's 5½ year lifetime, gathered valuable data about the thermosphere and greatly expanded our knowledge of the near space environment.

AE-5 was the first spacecraft to use onboard propulsion to make large orbit changes, and the first to use a central computer and data base, so that the data acquired are immediately accessible to all members of the investigator team via small terminals at their own facilities.

The spacecraft was built by RCA, Astro Division, and was operated out of the Multi-Satellite Operations Control Center (MSOCC) at NASA's Goddard Space Flight Center, Greenbelt, Md. Overall management and direction of the project was performed by Goddard for NASA's Office of Space Science.

Proposals Sought For Test Mirrors For X-Ray Observatory Program

A "request for proposal" was issued the last week of May to prospective contractors inviting them to describe how they would build precision mirrors of the type which later this decade will be flown on an orbiting X-ray observatory. The request for proposal, issued by NASA's Marshall Space Flight Center in Huntsville, Ala., remained open for 45 days.

Two contractors will be chosen from those responding to perform parallel but independent work toward the building of separate test mirrors. The mirrors will be representative of those to be flown in NASA's Advanced X-ray Observatory currently being studied and proposed for Space Shuttle launch later in the decade.

The test mirrors will be smaller than those actually to be built for the observatory. "Their purpose is not to be flown in space," said Carroll Dailey, a study manager in Marshall's X-ray astrophysics program, "but to allow NASA to evaluate the ability of these contractors to achieve the level of performance we are demanding. We are seeking a greater precision than previously achieved in X-ray optical systems."

The observatory will be the latest in a series of orbiting X-ray instruments that date back to the Uhuru satellite launched in 1970. It is expected to peer into space for X-ray sources toward the very edge of the observable universe. "These mirrors are crucial to that capability," said Dailey. "They're the heart of that observatory." The mirrors will focus the X-rays on imaging detectors. Coded pictures will be transmitted back to Earth, where the images will be decoded by computers.

The mirror designs called for in the request for proposal would be the grazing incidence type—meaning that the mirrors would be designed to be struck at a shallow angle by the X-rays. "Otherwise," said Dailey, "if the mirrors were faced more directly toward the stars, as with visible light telescopes, the X-rays wouldn't be reflected—they would be absorbed by the mirrors themselves. But with the mirrors lying almost flat in relation to the direction of the stars, the X-rays bounce off the surfaces much like stones skipping on a pond."

The 9,979-kilogram observatory, measuring 4.2 by 13.1 meters will be carried by the Space Shuttle and placed in an orbit 483 kilometers above the Earth for operation over a lifetime of about 15 years. It is expected to see X-ray sources that are 50 to 100 times weaker than those seen by its predecessor, the second High Energy Astronomy Observatory (also called the Einstein Observatory) launched in 1978. "HEAO-2 performed exceptionally well," said Dailey, "and we are looking forward to similar success with the Advanced X-Ray Astrophysics Facility.

"There will be a long gap between the completion of HEAO-2's operation and the beginning of the Advanced X-Ray Astrophysics Facility," Dailey said. "HEAO-2 far exceeded its lifetime, but it did end last month—and it's going to be a long while before the new observatory is placed in orbit. We are all eager to see the more advanced X-ray observatory launched in the 1980s for the scientific knowledge to be gained."

The Marshall Center's work on the X-ray telescope is sponsored by the Solar Terrestrial and Astrophysics Division of the Office of Space Science at NASA Headquarters in Washington.

NASA and Deere to Study Effects of Low-G on Iron Processing

A Technical Exchange Agreement—the first of its kind—has been signed between NASA and Deere and Company, Moline, Ill., to study the effects of low-gravity on various iron alloys.

Under the agreement signed with Deere, NASA's Marshall Space Flight Center, Huntsville, Ala., will use low-g facilities available to it—including drop tubes, KC-135 and F-104 aircraft, and possibly sounding rockets—to substantially reduce gravity conditions during alloy solidification experiments. Deere and Company will do sample preparation, ground-based characterization of the sample, extensive sample analyses and data reduction, as well as thermal characterization of the furnace used for melting and solidifying the samples.

The experiments and investigations performed under the agreement could eventually lead to Deere conducting research aboard a future Space Shuttle mission.

Data will be shared between the two parties. NASA and Deere personnel will visit each other's facilities and participate in experiment planning and analyses. The agreement is expected to be in effect for one year, but may be extended if needed.

The Technical Exchange Agreement represents one of several new concepts NASA has developed to

involve the private sector in the definitive stages of a low-gravity research program where technological advancement is needed and there is a potential commercial application. In these concepts for involving industry, NASA and a private company agree to be responsible for specific portions of the research effort and no funds are transferred between parties. The allocation of rights to resulting inventions and data is subject to negotiation between the parties for each effort undertaken.

NASA currently is carrying out low-g processing in such areas as alloy solidification, crystal growth, biological separations and chemical and fluid physics. NASA's Materials Processing in Space program has developed a variety of ground-based and flight facilities and experiment hardware to utilize the low-gravity environment, and has invited industry to participate in joint investigations and projects.

One of the new technologies which has emerged from the space program is the processing of materials in an environment where the effects of gravity are greatly reduced or eliminated. This reduced gravity is sometimes called low-gravity of microgravity. Early work done in the field has shown that low-gravity eliminates or greatly reduces the effects of buoyancy, sedimentation and convection on materials processes. This opens a new frontier for materials scientists and processors by providing new insights into the pervasive role of gravity on materials properties and process mechanisms.

Space Telescope Solar Wing Tested—One of the two solar wings which will power the Marshall Center-managed Space Telescope shown undergoing deployment testing on a water table at a British Aerospace Engineering plant in Bristol, England. The company is a prime contractor of the European Space Agency, which is responsible for design and development of the roll-out solar arrays. Electrical power—4,000 watts—will be provided to the spacecraft's electrical subsystem for conditioning, storage and distribution. The Space Telescope, being developed under overall management of NASA's Marshall Space Flight Center, Huntsville, Ala., is scheduled for launch aboard the Space Shuttle in 1985. The two solar arrays contain a total of approximately 48,000 solar cells. Each wing measures about eight feet wide and 18 feet long.

Awards Corner

Robert E. Lindstrom, Space Shuttle Projects Office manager at NASA's Marshall Space Flight Center, Huntsville, Ala., has been presented the annual **Holger N. Toftoy Award** by the Alabama Section of the American Institute of Aeronautics and Astronautics. The award is named for the American general credited with establishing the groundwork for the American rocket program. Lindstrom was cited for his "outstanding performance" as Marshall's Shuttle Projects manager.

James E. Webb, NASA Administrator from Feb. 14, 1961 to Oct. 7, 1968, has been selected to receive the **Sylvanus Thayer Award for 1981.** The Thayer Award has been presented annually since 1958 by the Association of Graduates, U.S. Military Academy, to an outstanding citizen of the United States "whose record of service to our country, accomplishments in the national interest and manner of achievement exemplify outstanding devotion to the principles expressed in the motto of West Point: "Duty, Honor, Country." Among previous recipients are John Foster Dulles, Dwight D. Eisenhower, and Douglas MacArthur.

J. Larry Crawford, Chief of NASA's Safety Office, received the **Department of the Army's Decoration for Meritorious Civilian Service,** the Army's second highest civilian award. Larry was cited for "exceptionally distinguished service to the Government and the Headquarters U.S. Army Materiel Development and Readiness Command (DARCOM) while serving as chief of its safety office." During his tenure as safety officer, DARCOM obtained the lowest injury and accident rate of any major Army command.

Dorthy Hubbard, a secretary in NASA's Marshall Space Flight Center office of the associate director for science, has been selected **Secretary of the Year** for the Alabama Division of the Professional Secretaries International. Ms. Hubbard, a Certified Professional Secretary, was selected at a division meeting in May. She represented the MSFC-Redstone Chapter, which named her local Secretary of the Year in January. As a division winner, Ms. Hubbard was considered as a candidate to represent the southeastern district at PSI's international convention in July.

James E. Kingsbury, director of the Science and Engineering Directorate at NASA's Marshall Space Flight Center, was named a **Fellow by the American Institute of Aeronautics and Astronautics** at its 50th anniversary annual meeting and technical display held recently in Long Beach, Calif. Kingsbury was cited for his contributions to astronautics through pioneering achievements in materials research and applications, and through design and development of rocket systems, space launch vehicles and spacecraft. Kingsbury joined the rocket research and development team at Redstone Arsenal, Ala., in 1951 and became directly involved in the design and development of the Redstone, Jupiter, Juno, Pershing and Saturn class launch vehicles. He transferred to NASA in 1960 when the Army Ballistic Missile Agency became the nucleus for the establishment of the Marshall Center.

Did You Know?

NASA was presented with Awards for outstanding Government publications produced in 1980 by the National Association of Government Communicators at a recent "Blue Pencil" Awards meeting. **High Energy Astronomy Observatory,** EP-167, received second place in the category "Popular publications exceeding 16 pages, four colors." The educational publication was edited by Wendell Johnson and Carroll Dailey of the Marshall Space Flight Center and James Cornell of the Harvard-Smithsonian Center for Astrophysics and was produced by the Education Services Branch at Headquarters. In the same category, honorable mention was awarded to **Voyager 1 Encounters Saturn** produced by the Jet Propulsion Laboratory with Audrey Steffan, the designer, and Andrea Stein, editor. Another JPL entry, "Voyager Encounters Jupiter," a series of six posters designed by Ken White, received second place in the "Graphics Design" category. The Scientific and Technical Information Branch at Headquarters also received two awards. William A. Dalton, writer-editor, received honorable mention for **Materials Processing in Space: Early Experiments,** SP-443, in the "Books, Technical" category. In "Books, Popular" **The Space Shuttle at Work"** SP-432, written by Howard Allaway, also received honorable mention.

A **program of research coordination in geodynamics** called "Dynamics and Evolution of the Lithosphere. The Framework for Earth Resources and the Reduction of Hazards" was established in late 1980 by the

International Council of Scientific Unions, at the recommendation of the International Union of Geodesy and Geophysics and the International Union of Geological Sciences. This International Lithosphere Program is a broadening and extension of the International Geodynamics Project, which had been sanctioned by the above-named organizations for the period 1970–79. The new program is managed by the Inter-Union Commission on the Lithosphere which will hold its first meeting in Canada in July 1981.

NASA is deeply involved in the International Lithosphere Program in two ways. First, measurements of plate motion and deformation now being conducted by NASA's Geodynamics Program are an important part of modern research in geodynamics and these measurements are making a unique and essential contribution to the Program. Second, the Geodynamics Program Scientist at NASA Headquarters, Dr. Edward A. Flinn, has been appointed Secretary-General of the Inter-Union Commission on the Lithosphere for the period 1980–83.

The lithosphere is the almost-rigid outer portion of the solid earth, frequently called the "crust." Accomplishing the objectives of the International Lithosphere Program will involve solving major problems in geodynamics: the present motion of the tectonic plates that compose the lithosphere; the origin of intraplate volcanism and seismicity; the driving forces that move the plates; the way the plates interact at their common boundaries (the location of most major earthquakes); and the way the lithosphere evolved to its present state. Two special objectives are to strengthen geosciences in developing countries, and to apply geodynamical knowledge to the exploration for mineral energy resources and to the mitigation of natural hazards. Brochures describing the International Lithosphere Program are available on request from Dr. Flinn, NASA Headquarters, Code ERG–2.

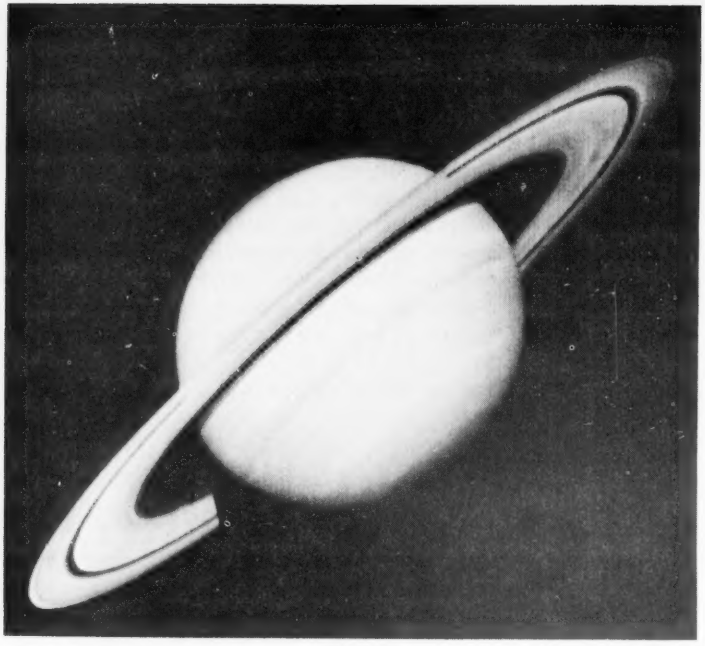
This year has been proclaimed the **International Year of Disabled Persons** (IYDP) by the United Nations General Assembly. NASA strongly supports programs that lead to improving the well-being and quality of life for disabled persons and has appointed the agency's first Handicapped Coordinator, Valerie J. Stucky, to coordinate all activities relating to the International Year of Disabled Persons and NASA's Handicapped Program. For further information on the IYDP and NASA's Handicapped Program, contact Valerie Stucky at NASA Headquarters, (202) 755–8307.

The Superintendent of Public Documents reported, for March 1981, 66 best sellers based on 3,000 copies per year since the publications concerned were placed on sale to the public. There are 34 NASA publications on the list which comprise 52 percent of the total.

Frank J. Nola of NASA's Marshall Space Flight Center's Electronics and Control Lab has been issued his tenth patent, the most patents received by a Marshall employee. The patent is for an improvement to the Power Factor Controller and will enable use of less expensive components in manufacturing the device. This latest Power Factor Controller patent is included within the coverage of licenses already issued by NASA to over 150 companies in this country and 10 foreign countries. In addition to patents on the power factor controller, Nola has received patents on a variety of other speed control inventions.

Idea Clearinghouse cites NASA's Langley Research Center for developing the Resource Escalation and Cost Analysis Computer Program (RECAP). Written in Fortran, the program integrates several common-cost estimating techniques into one project cost schedule. Extensive changes can be quickly projected for comparing alternatives for project management decisions. RECAP includes a model for computing and spreading escalating costs over as many as 60 time periods. The program is designed to identify both recurring and nonrecurring costs, including human resource requirements, for up to 1,000 project work segments. Further information on RECAP may be obtained by contacting Darrell Wood or Frederick Moore of the Langley Projects Directorate at FTS 928–3741.

The World Aerospace Film Festival held in Amsterdam on July 10 has honored the NASA film "Space For Women" with the Festival 3rd prize. This festival is sponsored by the World Aerospace Education Organization. "Space For Women" was produced by William Greaves with the NASA Headquarters motion picture officers, Ken Grimm (ret.) and Byron Morgan supervising. Curtis Graves of Academic Affairs Division was the technical advisor. "Space For Women," released three months ago, has also won the Cine "Golden Eagle" and the "Silver Screen Award" from the U.S. Industrial Film Festival. The NASA film program is rated as the most successful documentary group of films in the United States with 241 International film festival awards.



Voyager 2 Approaching Saturn— Voyager 2's photograph of Saturn taken June 28, 1981 while the spacecraft was still 59 days and 56 million kilometers from its August 25 closest approach.

Contractor News

ACL-Filco Corp., Santa Ana, Calif., has been awarded a $2,190,844 contract by NASA's Kennedy Space Center, Fla., to produce 26 control panels used in processing Space Shuttle orbiters between missions. The panels and associated hardware are used in draining hypergolic propellants from the orbiter's auxiliary propulsion system and the forward reaction control system, securing those systems and checking them out. ACL-Filco is a small business firm; work is to be completed between mid-May 1981 and Oct. 1982.

Dalton-Dalton-Newport, Cleveland, has been selected by NASA's Lewis Research Center, Cleveland, for contract negotiations for services, labor and materials for engineering and construction for modification and repairs of institutional facilities and systems at Lewis. The one-year cost-plus-award-fee service contract is to include four one-year options and became effective in June. Cost of the one-year contract is expected to be about $2.2 million. Professional engineering services are to be performed at the contractor's offices and construction services on-site at Lewis.

Thiokol Corp., Huntsville, Ala., has been awarded a letter contract approximating $46,600,000 by the Goddard Space Flight Center, Greenbelt, Md., for production of 126 solid propellant rocket motors (Castor IVs). These motors are used as strap-on motors to augment the Delta Space Research Vehicle. Technical direction of the Delta program is performed by Goddard under the overall direction of NASA's Office of Space Transportation Operations.

Atlantic Technical Services, Inc., has been awarded a one-year contract extension valued at $1,121,274 by NASA's Kennedy Space Center, Fla., for providing mail and distribution services in support of NASA and NASA contractors at the Space Center. This contract extension covers the period from May 1, 1981 through April 30, 1982.

IBM Corporation, Gaithersburg, Md., has been selected for negotiation of a four-year fixed-price contract by NASA's Goddard Space Flight Center, Greenbelt, Md., for the acquisition and maintenance of a new computing system to replace one that has been in use since 1967. The contract negotiation was based on an offer of $16.6 million. New equipment will be phased into use at Goddard's Science and Application Computing Center.

Boeing Engineering and Construction Co., Seattle, Wash., has been awarded a $1,593,037 contract by NASA's Lewis Research Center, Cleveland, to build a Mod-2 wind turbine generator for installation at Medicine Bow, Wyo. This generator supplies enough power equivalent to meet the needs of about 700 families. The work, done for the Department of the Interior's Water and Power Resources Service, calls for the project to be completed in two phases. The first phase is to build or buy all of the materials and components necessary to build the wind turbine generator and erect the tower. The optional second phase calls for complete installation and acceptance testing of the wind turbine generator and the training of operating personnel. Work performed in the second phase is valued at $2,137,729 and would increase the total contract value to $3,730,766. Lewis manages wind turbine programs for the Department of Energy and provides project management for the design, fabrication, installation and checkout and initial operation of the wind turbine generator.

Boeing Computer Services Company, Inc., Vienna, Va., has been selected for negotiation of a contract by NASA's Marshall Space Flight Center, Huntsville, Ala., for computational support services at the Center. The contract will run for one year beginning Sept. 1, 1981 with two firm one-year options and two additional option periods, spanning a total of five years. The contractor's estimated cost for the work is approximately $6 million for the first year and approximately $19 million for three years. The cost-plus-award-fee mission contract will provide for multi-program, administrative and institutional support at the Marshall Center's Computer Services Office, Huntsville Computer Complex. The contractor effort can be broken down into the following functional elements: resources management; computer operations and systems software; equipment maintenance; data preparation; and applications software development and maintenance.

Specialty Maintenance and Construction, Inc., Lakeland, Fla., was awarded a fixed-price contract by NASA's Kennedy Space Center, Fla., to update lighting, heating, ventilating and air conditioning systems in the Central Instrumentation Facility Building which houses the central computer complex as well as a number of technical laboratories at the Center. The contract with the firm totals $1,097,624 and is a result of a set-aside for small business firms.

Management Services, Inc., Kennedy Space Center, Fla., has been awarded an extension to an existing contract by the Space Center to perform precision cleaning and chemical analysis services at the Center. The cost-plus-fixed-fee contract extension is for $2,513,712 and brings the total value of the contract to $13,166,306. The extension covers a period from June 1, 1981 through February 28, 1982. Under the terms of the contract, Management Services, Inc., performs gas and liquid chemical sampling and analysis at the Space Center as well as pre-cleaning and reassembly of propellant and pneumatic system valves.

Applied Technology Division, Falls Church, Va., has been awarded an extension to an existing contract by NASA's Kennedy Space Center, Fla., to perform a wide variety of technical support services for the Space Center ranging from Shuttle launch computer operation to radio frequency control and analysis. The cost-plus-award-fee contract extension is for a total of $45,553,211 bringing the total contract value to about $155,500,480. The extension covers a period from June 1, 1981 through May 31, 1982.

Honeywell, Inc., Electro-Optics Operations, Lexington, Mass., has been awarded a six-month fixed-price study contract in the amount of $450,000 by NASA's Goddard Space Flight Center, Greenbelt, Md., for the design of a spaceborne sensing instrument for NASA-sponsored Earth-resources surveys. Under the contract, Honeywell will provide conceptual design and systems integration of optics, focal plane detector assemblies, signal processing electronics and space radiative cooling equipment for Multispectral Linear Array earth-resources survey equipment.

Greenbush Services, Inc., Parksley, Va., has been awarded a fixed-price contract in the amount of approximately $1.7 million by NASA's Wallops Flight Center, Wallops Island, Va., to provide supply management and materials handling services. Services to be provided are complete stores management, operation of the Federal cataloging program, shipping and receiving, materials handling operations, inventory control, and utilization and disposal functions.

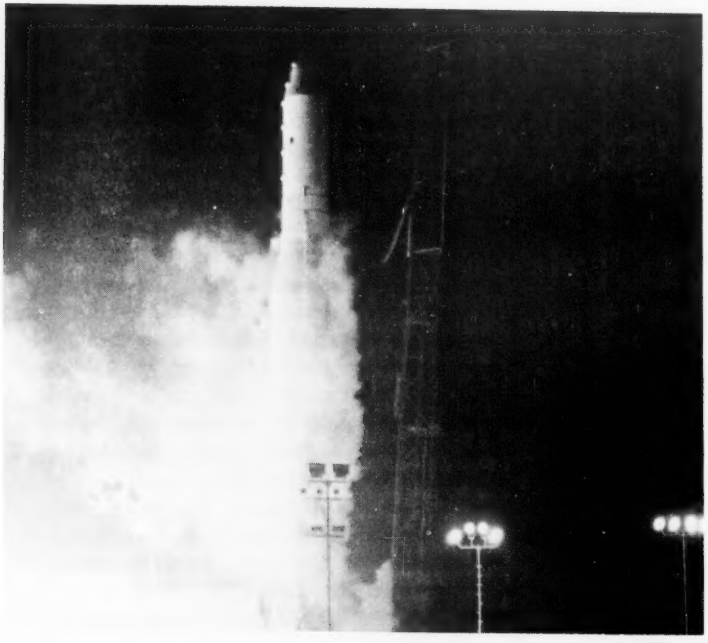
Computer Sciences Corp., Silver Spring, Md., has been selected by NASA's Goddard Space Flight Center, Greenbelt, Md., to enter into negotiations for a four-year contract to provide Payload Operations Control Center applications software support for the Space Telescope. Estimated amount of the cost-plus-award-fee contract will be approximately $8.5 million.

Expendable Launches for 1981

Name	Launch Date	Vehicle	Range	Mission Remarks
COMSTAR-D	February 21	Atlas Centaur	ESMC	Comsat General Corp. communications. Reimbursable.
GOES-E	May 22	Delta	ESMC	NOAA weather. Reimbursable.
Intelsat V-B	May 23	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.
Navy 20 (NOVA 1)	2nd quarter	Scout	WSMC	DOD transit. Reimbursable.
NOAA-C	June 22	Atlas-F	WSMC	NOAA weather. Reimbursable.
Dynamic Explorer	July 31	Delta	WSMC	NASA scientific.
FLTSATCOM-E	August 6	Atlas Centaur	ESMC	DOD communications. Reimbursable.
SBS-B	August 20	Delta	ESMC	SBS communications. Reimbursable.
Solar Mesospheric Explorer	September 15	Delta	WSMC	NASA scientific.
Intelsat V-C	September 24	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.
RCA-D	October 15	Delta	ESMC	RCA communications. Reimbursable.
NOAA-D	October	Atlas-F	WSMC	NOAA weather. Reimbursable.
RCA-C1	December 3	Delta	ESMC	RCA communications. Reimbursable.
Intelsat V-D	December	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.
Navy 21 (NOVA 2)	4th quarter	Scout	WSMC	DOD transit. Reimbursable.

Space Shuttle Launches for 1981

Orbiter	Launch Date	Launch site	Payload
OV-102	April 12	KSC	
OV-102	Sept. 30	KSC	OSTA-1



NOAA-C Successfully Launched—NASA successfully launched June 23 a new environmental monitoring satellite for the National Oceanic and Atmospheric Administration (NOAA), the NOAA-C. Liftoff occurred at 6:53 EDT from the Western Space and Missile Center, Vandenberg AFB, Lompoc, Calif., aboard an Atlas-F expendable launch vehicle. The spacecraft is in a near circular orbit of 470 x 469 nautical miles with an orbit inclination of 98.85 degrees. Orbit revolution time is 102 minutes. Once in orbit, the satellite's designation became NOAA-7. This satellite carries the most versatile scanning radiometer ever sent aloft in an environmental spacecraft.

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) and Employer	Title	Patent No.	Installation
Stephen C. Irick, NASA/LaRC	Hydraulic actuator mechanism to control aircraft spoiler movements through dual input commands	4,272,046	LaRC
Murzban D. Jhabuala, NASA/GSFC	Method of making V-MOS field effect transistors utilizing a two-step anisotropic etching and ion implantation	4,272,302	GSFC
Li-Chen Hsu, Dean W. Sheibley and Warren H. Phillip, NASA/LeRC	Cross-linked polyvinyl alcohol and method of making same	4,272,470	LeRC
Carl L. Lennon, NASA/KSC	Lightning discharge identification system	4,272,720	KSC
R. W. Rosser, I. M. Shalhoub, and Hanoi Kwong, San Jose Univ., San Jose, Calif.	1, 2, 4 – oxadiazole elastomers	4,273,918	ARC
K. H. Clark and J. D. Johnston, NASA/MSFC	Pneumatic inflatable end effector	4,273,505	MSFC
P. L. Lawing and L. L. Pagel, McDonnell Douglas Aircraft Corp., St. Louis, Mo.	Cooling system for an aircraft having a cruise range from mach 2 to mach 8	4,273,304	LaRC
Ralph V. Sawyer, NASA/DFRC	Electrical servo activator bracket	4,274,038	DFRC
Gerald C. Purgold, NASA/LaRC	Automated syringe sampler	4,274,285	LaRC
Wolf Elber, NASA/LaRC	Method of making a partial interlaminar separation composite system	4,274,901	LaRC
James B. Laudenslager and Thomas J. Pacala, Caltech/JPL Pasadena, Calif.	Pulse switching for high energy lasers	4,275,317	NRO/JPL
Charles A. Wagner, NASA/DFRC	Smoothing filter for digital to analog conversion	4,275,453	DFRC
George M. Fohlen, John A. Parker, Indra K. Varna, National Research Council, Washington, DC	Phosporus-containing bisimide resins	4,276,344	ARC
Gustave J. Schaefer, Hughes Aircraft Company, Los Angeles, Calif.	Apparatus and method for determining the position of a radian energy source	4,276,553	GSC
CO. W. T. McLyman, Caltech/JPL, Pasadena, Calif.	Push-pull converter with energy saving circuit for protecting switching transistors from peak power stress	4,276,588	NRO
Larry L. Fewell, John P. O'Brien, Harry R. Allcock, Angelo G. Scopelianos, NASA/ARC and The Pennsylvania State University, University Park, Pa.	Process for the preparation of polycarboramylphosphazenes	4,276,403	ARC
Algirdas C. Poshkus, National Research Council Washington, D.C.	Improved synthesis of polyformals	4,277,402	ARC
Henry G. Kosmahl, NASA/LeRC	Multistage depressed collector for dual mode operation	4,277,721	LeRC
Harry F. Benz, NASA/LaRC	Image readout device with electronically variable spatial resolution	4,279,001	LaRC
Everett A. Johnston and Edward W. Ryan, General Electric Company Cincinnati, Ohio	Thrust reverser for a long duct fan engine	4,278,220	LeRC
Richard J. Stirn, Yea-Chuan M. Yeh, Caltech/JPL, Pasadena, Calif.	Schottky barrier solar cell and method of fabrication	4,278,830	NRO

Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

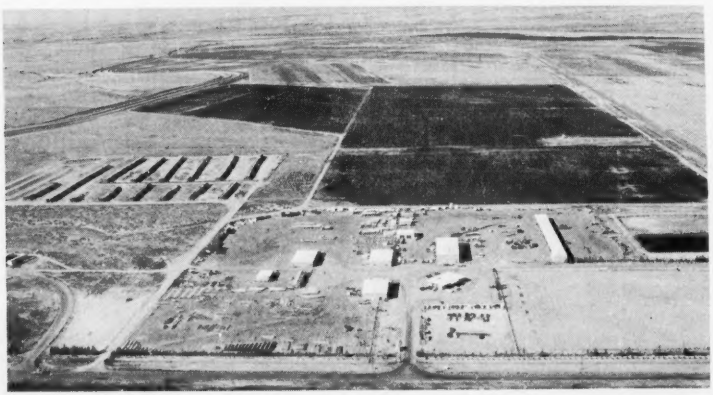
Management Technique

Aerospace spinoffs usually involve hardware, software, or industrial processes, but there are other types of technology transfers.* One of them is the highly efficient management method known as the "total integrated systems approach" a technique developed of necessity for managing extremely complex aerospace programs involving integration of a great many individual systems. These systems, developed at different times by many different companies, must not only work perfectly when separately tested, they must also perform compatibly when integrated into the complete prime system. The systems approach is essentially a carefully-considered, painstakingly-executed master plan for coordinated design, development and assembly of the multitude of elements that constitute the end product. Its intent is to eliminate the problems that may occur when the specific parts of a total functioning system fail to come together to provide the requisite performance of the prime system.

The systems approach has obvious applicability to management of similarly complex non-aerospace programs, and it is being applied by a number of companies which developed their project management and systems analysis techniques in work for NASA and other government agencies. One example is Ball Corporation, Muncie, Indiana, whose Ball Aerospace Division has been a major contractor on a number of space projects. The techniques developed and refined by Ball Aerospace are being applied by the parent company's Agricultural Systems Division in planning, designing, developing and managing major agricultural programs in the United States and developing countries.

The photo below illustrates Ball Agricultural projects wherein the systems approach was employed. Shown is an agricultural development in New Mexico.

NASA does not endorse commercial products developed as a result of its Technology Utilizatiin or Patent Licensing Programs, but it does encourage the widest possible use of such technology.



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